

2nd Semester Review Practice Problems

Chem Pre-AP

You will need to complete the following practice problems. Please use your book, notes, and the following formulas to work through them. These problems cover the **CONCEPTS** that you will see on the final **NOT** the exact wording or direction of the questions on the final. The following periodic table, formulas, and Standard Reduction Potential Table will be provided to you on the final. Use more paper as needed.

PERIODIC CHART OF THE ELEMENTS

IA	IIA	IIIB	IVB	VB	VIB	VII B	VIII	IB	IIB	IIIA	IVA	VA	VIA	VIIA	INERT GASES		
<div>1</div> <div>H</div> <div>1.00797</div>														<div>2</div> <div>He</div> <div>4.0026</div>			
<div>3</div> <div>Li</div> <div>6.939</div>	<div>4</div> <div>Be</div> <div>9.0122</div>																
<div>11</div> <div>Na</div> <div>22.9898</div>	<div>12</div> <div>Mg</div> <div>24.312</div>																
<div>19</div> <div>K</div> <div>39.102</div>	<div>20</div> <div>Ca</div> <div>40.08</div>	<div>21</div> <div>Sc</div> <div>44.956</div>	<div>22</div> <div>Ti</div> <div>47.90</div>	<div>23</div> <div>V</div> <div>50.942</div>	<div>24</div> <div>Cr</div> <div>51.996</div>	<div>25</div> <div>Mn</div> <div>54.9380</div>	<div>26</div> <div>Fe</div> <div>55.847</div>	<div>27</div> <div>Co</div> <div>58.9332</div>	<div>28</div> <div>Ni</div> <div>58.71</div>	<div>29</div> <div>Cu</div> <div>63.54</div>	<div>30</div> <div>Zn</div> <div>65.37</div>	<div>31</div> <div>Ga</div> <div>69.72</div>	<div>32</div> <div>Ge</div> <div>72.59</div>	<div>33</div> <div>As</div> <div>74.9216</div>	<div>34</div> <div>Se</div> <div>78.96</div>	<div>35</div> <div>Br</div> <div>79.909</div>	<div>36</div> <div>Kr</div> <div>83.80</div>
<div>37</div> <div>Rb</div> <div>85.47</div>	<div>38</div> <div>Sr</div> <div>87.62</div>	<div>39</div> <div>Y</div> <div>88.905</div>	<div>40</div> <div>Zr</div> <div>91.22</div>	<div>41</div> <div>Nb</div> <div>92.906</div>	<div>42</div> <div>Mo</div> <div>95.94</div>	<div>43</div> <div>Tc</div> <div>(99)</div>	<div>44</div> <div>Ru</div> <div>101.07</div>	<div>45</div> <div>Rh</div> <div>102.905</div>	<div>46</div> <div>Pd</div> <div>106.4</div>	<div>47</div> <div>Ag</div> <div>107.870</div>	<div>48</div> <div>Cd</div> <div>112.40</div>	<div>49</div> <div>In</div> <div>114.82</div>	<div>50</div> <div>Sn</div> <div>118.69</div>	<div>51</div> <div>Sb</div> <div>121.75</div>	<div>52</div> <div>Te</div> <div>127.60</div>	<div>53</div> <div>I</div> <div>126.904</div>	<div>54</div> <div>Xe</div> <div>131.30</div>
<div>55</div> <div>Cs</div> <div>132.905</div>	<div>56</div> <div>Ba</div> <div>137.34</div>	<div>57</div> <div>La</div> <div>138.91</div>	<div>72</div> <div>Hf</div> <div>178.49</div>	<div>73</div> <div>Ta</div> <div>180.948</div>	<div>74</div> <div>W</div> <div>183.85</div>	<div>75</div> <div>Re</div> <div>186.2</div>	<div>76</div> <div>Os</div> <div>190.2</div>	<div>77</div> <div>Ir</div> <div>192.2</div>	<div>78</div> <div>Pt</div> <div>195.09</div>	<div>79</div> <div>Au</div> <div>196.967</div>	<div>80</div> <div>Hg</div> <div>200.59</div>	<div>81</div> <div>Tl</div> <div>204.37</div>	<div>82</div> <div>Pb</div> <div>207.19</div>	<div>83</div> <div>Bi</div> <div>208.980</div>	<div>84</div> <div>Po</div> <div>(210)</div>	<div>85</div> <div>At</div> <div>(210)</div>	<div>86</div> <div>Rn</div> <div>(222)</div>
<div>87</div> <div>Fr</div> <div>(223)</div>	<div>88</div> <div>Ra</div> <div>(226)</div>	<div>89</div> <div>Ac</div> <div>(227)</div>	<div>104</div> <div>Rf</div> <div>(261)</div>	<div>105</div> <div>Db</div> <div>(262)</div>	<div>106</div> <div>Sg</div> <div>(266)</div>	<div>107</div> <div>Bh</div> <div>(266)</div>	<div>108</div> <div>Hs</div> <div>(265)</div>	<div>109</div> <div>Mt</div> <div>(266)</div>	<div>110</div> <div>?</div> <div>(271)</div>	<div>111</div> <div>?</div> <div>(272)</div>	<div>112</div> <div>?</div> <div>(277)</div>						

Numbers in parenthesis are mass numbers of most stable or most common isotopes.

Atomic weights corrected to conform to the 1963 values of the Commission on Atomic Weights.

The group designations used here are the former Chemical Abstract Service numbers.

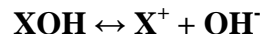
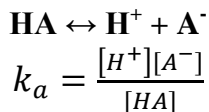
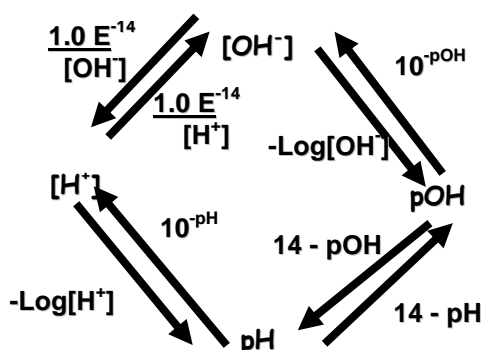
* Lanthanide Series

58	59	60	61	62	63	64	65	66	67	68	69	70	71
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
140.12	140.907	144.24	(147)	150.35	151.96	157.25	158.924	162.50	164.930	167.26	168.934	173.04	174.97

† Actinide Series

90	91	92	93	94	95	96	97	98	99	100	101	102	103
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
232.038	(231)	238.03	(237)	(242)	(243)	(247)	(247)	(249)	(254)	(253)	(256)	(256)	(257)

Acid Base Chemistry



$$K_b = \frac{[OH^-][B^+]}{[BOH]}$$

$$M_a V_a = M_b V_b$$

Solutions:

$$\text{Molarity} = \frac{\text{mol}_{\text{solute}}}{L_{\text{solution}}}$$

$$\text{Molality} = \frac{\text{mol}_{\text{solute}}}{\text{kg}_{\text{solvent}}}$$

Gas Laws

Grams/ Vol A \rightarrow Moles A \rightarrow Moles B \rightarrow Grams/ Vol B

$$P_1V_1=P_2V_2, \quad \frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}, \quad \frac{V_1}{T_1} = \frac{V_2}{T_2}, \quad PV=nRT, \quad d = \frac{PM}{RT}$$

$$R = 0.0821 \frac{L \cdot atm}{mol \cdot K}$$

$$1 \text{ atm} = 760 \text{ mmHg} = 760 \text{ torr} = 101.325 \text{ kPa}$$

$$\text{STP} = 0^\circ\text{C and } 1 \text{ atm} \quad K = 273 + ^\circ\text{C}$$

Electrochemistry

Acidic solution:

1. Assign oxidation numbers to determine what is oxidized and what is reduced, if no change in oxidation numbers occurs it is not a redox reaction and you must balance by inspection.
2. Write the oxidation and reduction half-reactions.
3. Balance each half-reaction.
 - a. Balance elements other than H and O.
 - b. Balance O by adding H_2O .
 - c. Balance H by adding H^+ .
 - d. Balance charge by adding electrons.
4. Multiply the half-rxn by integers so that the e^- gained and lost are the same.
5. Add the half-reactions, subtracting things that appear on both sides.
6. Make sure the equation is balanced according to mass and to charge.

In a **Basic Solution**: Once the equation is balanced, add OH^- to each side to "neutralize" the H^+ in the equation and create water in its place. $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
If this produces water on both sides, you might have to subtract water from each side.

Practice Problems:

Stoichiometry

Mole A to Mole B and Gram A to Gram B

Mole Bridge

Limiting reagents

1. What is stoichiometry?
2. How is the Mole Bridge formulated?
3. What amount of moles of H_2 gas is formed from the rxn of 10g of Zn and excess HCl, if only Zinc (II) Chloride and hydrogen gas are formed?
4. Based on the previous problem how many grams of hydrogen gas is formed if the 10g Zn is reacted with 10g HCl?

Gas laws

Pressure and conversions

Kelvin

Boyles

Charles

Avogadro's

Combined

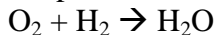
Ideal

Gas constant

Density/ Molar mass

1. How many kPa are equivalent to 2.5atm?
2. A 0.500 L flask containing helium gas at 740 mmHg is connected to a system under vacuum and allowed to expand into the system. The final pressure observed is 222 mmHg. What is the volume of the system (L)?
3. A 50.0-mL container has a gas at a pressure of 645 atm and a temperature of 25°C . The entire sample is heated to a temperature of 35°C and transferred to a new container whose volume is 65.0 mL. What is the pressure (atm) of the gas in the second container?
4. A 725 gram sample of neon is introduced into a 4.5 L cylinder which is then heated until the pressure is 225 atm. What is the temperature ($^\circ\text{C}$) of the gas?
5. If the total pressure of a tank containing 0.25atm of N_2 , 0.10atm of H_2S , 0.55 atm Ar and Cl_2 gas is 1.25atm what is the pressure of Cl_2 ?

6. When 1mol of O_2 gas is combusted with hydrogen according to the unbalanced equation below, how many L of H_2O are produced at STP? (Use stoichiometry first!)



7. What volume of hydrogen gas is produced at 335K and 1.2atm, if 5g of Mg is reacted with excess HCl producing only $MgCl_2$ and H_2 gas?

8. What is the density of the hydrogen gas in the previous problems?

Solutions

Concentrations

Molarity

Molality

% mass/volume (g/100mL)

Dilutions

Making solutions

Precipitation

Net ionic equations

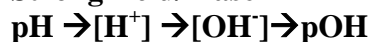
1. What are the formulas for determining Molarity and Molality?
2. What is the molarity of 2.3g of KOH dissolved in water to a volume of 450mL?
3. What volume of 11M HNO_3 should be used to prepare 250mL of 0.8M HNO_3 ?
4. A student wishes to prepare approximately 100 milliliters of an aqueous solution of 6M HCl using 12 M HCl. Which procedure is correct?
 - adding 50 mL of 12M HCl to 50 mL of water while stirring the mixture steadily.*
 - adding 50 mL of 12M HCl to 50 mL of water & then stirring the mixture steadily.*
 - adding 50 mL of water to 50 mL of 12M HCl while stirring the mixture steadily.*
 - adding 50 mL of water to 50 mL of 12M HCl & then stirring the mixture steadily.*
5. What are the solubility rules for sulfate, hydroxides, nitrates, group 1 metals, and chlorides?
6. What, if any, would be the precipitate of the mixing a solution of $Ba(OH)_2$ with $Pb(NO_3)_2$?
7. What is the net ionic equation of the previos questions ($Ba(OH)_2$ with $Pb(NO_3)_2$)?

Acid Base

Definitions

Nomenclature

Strong Acid/ Base



Titration

Weak Acid/ Base

K_a/K_b

ICE tables

1. What is an Arrhenius acid?

2. Name the following acids/bases.

Which substance can be classified as strong acid? Why?



3. What is the pH of a 1.0×10^{-5} molar HCl solution? $[\text{OH}^-]$?

4. Which 0.1 M solution will turn phenolphthalein pink?



5. The following data were collected at the endpoint of a titration performed to find the molarity of an HCl solution.

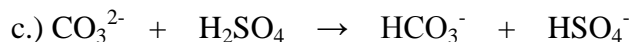
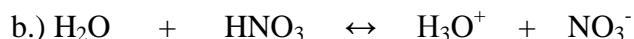
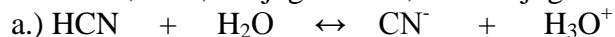
Volume of acid (HCl) used = 14.4 mL

Volume of base (NaOH) used = 22.4 mL

Molarity of standard base (NaOH) = 0.200 M

What is the molarity of the acid solution?

6. Label the acid, base, conjugate base, and conjugate acid in the reactions below:

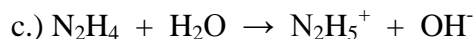
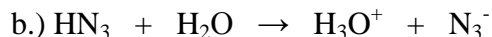
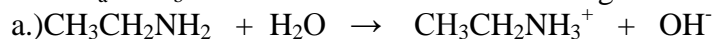


7. What is the equilibrium equation for the dissociation of the following acids, treat all as mono-protic, loss of only 1 H^+):

a. Citric Acid: $\text{H}_3\text{C}_6\text{H}_5\text{O}_7$

b. Phosphoric Acid: H_3PO_4

8. Write the K_a or K_b for the reactions of the following acids or bases with water:



9. What is the pH of a 1.5M solution of nitrous acid, $K_a = 4.0 \times 10^{-4}$? (write the K_a expression first).

10. What is the pH of a 0.5M of NH_3 ($k_b = 1.8 \times 10^{-5}$) (use an ICE table)

11. **Review your standardization titration lab calculations!**

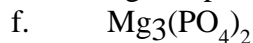
Redox and Electrochem

Oxidation number

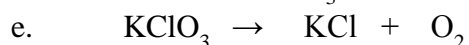
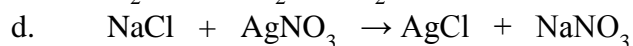
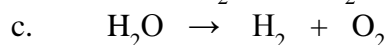
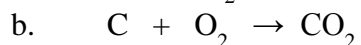
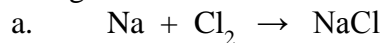
$\frac{1}{2}$ Rxn Balancing method

1. What is a redox Reaction?

2. Indicate the oxidation number for each element in the following compounds:



3. Determine which of the following are Redox rxns, and if it is a redox; 1 determine what is being reduced/ oxidized AND balance it using $\frac{1}{2}$ rxn method..



Thermochemistry

1. What is the 1st law of thermodynamics?